IoT at scale with AWS

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#AWSSummit
@awscloud_es
Agenda

What our customers are doing
AWS IoT inside out
What living on the edge is like
Introducing AWS Greengrass
Customer Case: Enel
What our customers are doing
RioTinto
Avoids the high cost of truck repairs with vibration telemetry

• One-touch exercise to attach a vibration metering device to each truck that collects telemetry and aggregates it to come up with a road roughness index

• Combines roughness index and geolocation data to create heat maps depicting smooth vs. rough roads that need to be avoided & fixed

• Leverages AWS GreenGrass to overcome intermittent connectivity at the mining site

• First deployment at Boron Mining site took two weeks

Video: https://www.youtube.com/watch?v=6RM0ZqR8u0U&t=14m24s
BMW

Creates customer value with **Connected Car** powered by AWS

- IoT is key to create differentiation in the automotive industry
- Connected-car application collects anonymous sensor data from BMW 7 Series cars to give drivers dynamically updated map information
- Built its new car-as-a-sensor (CARASSO) service in only six months
- By 2018 CARASSO is expected to process data collected by a fleet of 100,000 vehicles traveling more than eight billion kilometers.
- Lessons Learned: It is not enough to have a vehicle that can drive itself, it must be able to drive in a world of human drivers

Video: [https://www.youtube.com/watch?v=cyqzbwvyxU](https://www.youtube.com/watch?v=cyqzbwvyxU)
iRobot

Improves consumer IoT with connected Roomba

- Connected Roomba is used to create maps of a house, identifying different spaces – rooms – and the connected devices that are around: lights, tv, sound system
- Roomba vacuum cleaning robot will enable the smart home of the future
- iRobot has sold more than 15 million home robots worldwide
- First connected Roomba launched in 2015 has already mapped more than 500 million square feet of floor space

Video: https://www.youtube.com/watch?v=zf-06mWLrwM
Philips Healthcare
Uses AWS IoT to collect and act on critical data across different devices

With the addition of AWS IoT, we will greatly accelerate the pursuit of our vision by making it easy to acquire, process, and act on data from heterogeneous devices in real time.

Jeroen Tas
CEO Healthcare Informatics Solutions and Services, Philips

• AWS gives Philips customers greater control of their health with connected digital health solutions that support healthy living and improved care coordination.

• HealthSuite is a digital platform that manages more than 7 million connected medical-grade, consumer devices, sensors, and mobile apps.

• The Philips HealthSuite digital platform analyzes and stores 15 PB of patient data from 390 million imaging studies, medical records, and patient inputs.

• AWS provides the reliability, performance, and scalability that Philips needs to help protect patient data which grows by petabyte/month.

Philips is a leading health-tech company, working to create a new era of connected and personalized digital health and care.

Video: https://www.youtube.com/watch?v=7NvcvPZT8QE
AWS IoT inside out
AWS IoT Vision and Pillars

“Securely connect one or one-billion devices to AWS, so they can send data and interact with applications, services and other devices”

1. Securely connect your fleet of devices to AWS
   - Connect any device securely
   - Quickly get started with AWS IoT Starter Kits and scale to billions of messages across millions of devices

2. Collect data from your fleet of devices and act on it
   - Route data collected to AWS service of your choice for storage, analysis, processing and visualization

3. Interact with your fleet of devices reliably at any time
   - Easily build applications on web and mobile that interact with devices, even when they are offline
AWS IoT Platform

All-in-one service
- Device registration & management
- + Authentication & authorization
- + Device gateway (Message broker)
- + Rules engine
- + APIs & SDKs

Managed service
No installation
Automatic scaling
No pre-provisioning
Redundant across AZ
Pay as you go
Device Registry

Device metadata store
Unlimited number of registry entries
Classify devices by metadata

Enforce Schema
Can define Thing Types with set schema
Define up to 50 attributes per Thing
Security, Security, Security

**Most trusted authentication**
X509 Certificates with mutual authentication

**Higher level of encryption**
TLS 1.2

**Easy onboarding and provisioning**
Generate unlimited amount of certificates
Or have AWS IoT sign your CSR
Or bring your own certificate (BYOC)
Just-in-time registration (JITR)

**Policy and role based access control**
Granular access to the message broker for devices and IAM identities (users)
Amazon Cognito integration for web and mobile apps
Granular access to backend services via Roles
Device Gateway

Publish / Subscribe architecture
Topic hierarchy

Standard protocol support
MQTT, HTTPS, WebSockets

Constrained device friendly
Low power, low bandwidth, fast

Long lived connections
Receive signals from the cloud

Bidirectional
Communication FROM and TO the devices no matter the protocol used
Device Gateway / Topic Hierarchy

**Publishers**
- building1/floor0/sensor1
- building1/floor0/sensor2
- building1/floor1/sensor1
- building1/floor2/sensor1

**Topics**
- building1/floor0/+
- building1/floor2/sensor1

**Subscribers**
- building1/floor0/+
- building1/floor2/sensor1
- building1/#
Device SDKs

Open Source, Apache 2.0

Embedded C

Node.js
Python

Java
C++

Arduino Yún

Arduino

Android & iOS

Micro-controllers
Embedded platforms

RTOS

https://aws.amazon.com/iot/sdk/
Rules Engine

Filter Messages
Avoid processing noise

Transforms & Enrich Messages
Extract only attributes of interest
String manipulation, Math library
Built-in functions: UUID, timestamp, rand…

Easy SQL-Like Syntax
SELECT attributes FROM topic WHERE conditions, IF MATCH THEN action(s)

Actions
Route to other topics (republish)
Integrate with AWS Services
Integrate with 3rd Parties (Salesforce)
Rules Engine

SELECT DATA FROM TOPIC WHERE FILTER

THEN ACTION
Integration with Amazon Machine Learning

> Predict() Function

**Three types of prediction**

1. **Binary classification**
   - one of two possible choices
2. **Multiple classification**
   - one of more than 2 choices
3. **Regression**
   - predict a numeric value

**Model training**
Place new data in S3 to trigger a new training cycle

```sql
SELECT predict(model ID) as prediction FROM /device/data
WHERE temperature > 150
ACTION trigger a Lambda function
```
Integration with Amazon Elasticsearch

> Elasticsearch Action

**Simplifies visualization**
Leverage Kibana for fast and easy visualization of data

**Enables complex queries**
Averages, time bound, and more…
**AWS IoT Device Shadow**

**Virtual representation of the device**
Always accessible
Holds “states” up to 1 year

**Mindful of device constraints**
Holds the commands until device is ready
Can be queried in lieu of the device
Lightweight and fast

**More efficient programming**
Familiar REST APIs for read/write
Hide complexity of device connectivity
How AWS IoT Device Shadow Works

```
{
    "state" : {
        "desired" : {
            "lights" : {"color": "RED"},
            "engine" : "ON"
        },
        "reported" : {
            "lights" : {"color": "GREEN"},
            "engine" : "ON"
        },
        "delta" : {
            "lights" : { "color": "RED"}
        }
    },
    "version" : 10
}
```

- Write to `state.desired` to act on a device w/o having to directly connect to it.
- Read from `state.reported` to know about the reported state of a device.
- Read from `state.desired` to see if applications want to act on the device.
- Write to `state.reported` to let the applications know about its current state.
- Generates `state.delta`.
- Notifies `state.delta` when connectivity permits.
What living on the edge is like
Most machine data never reaches the cloud

Medical equipment

Industrial machinery

Extreme environments
This problem is not going away

Law of physics

Law of economics

Law of the land
Introducing AWS GreenGrass
AWS Greengrass

Going to the **edge**
AWS Greengrass

Going to the edge

*Note: Greengrass is NOT Hardware (You bring your own)
Benefits of AWS Greengrass

**Speed**
Respond to local events quickly

**Cost**
Reduce the cost of IoT applications

**Overcome network constraints**
Round-trip latency
Intermittent connectivity
Expensive bandwidth

**Simplify Deployment**
Same deployment model – local and in the cloud – with AWS Lambda
Customer case: Enel
AWS Summit Madrid
Gabriel Andrés (gabriel.andres@enel.com)
Enel / ICT_Iberia / Digital Transformation

21/09/2017
Acerca de Enel
Operador integrado global de energía
We are opening energy access to more people

We are opening the world of energy to new technologies

We are opening new ways for people to manage energy

We are opening new uses of energy
AWS IoT en Enel

El desafío

Clientes Residenciales

Clientes Industriales

Instalaciones
**AWS IoT en Enel**

**Ejemplo de aplicación de IoT: EMS para clientes industriales**

**Alcance**

El objetivo del Piloto es construir una primera versión de la Plataforma para la entrega de servicios energéticos a Clientes, en particular:

- Desarrollo de un Sistema de Control y Monitorización del Consumo de Energía
- Identificar y desarrollar, en colaboración con los clientes, los nuevos servicios / soluciones de Enel para enriquecer nuestra cartera de servicios energéticos

1. **Energy Management services**
   - Energy audit
   - Energy model
   - Site inspection
   - Online auctions and sources negotiation

2. **Data Acquisition**
   - Technical site inspection
   - Sensors design
   - Sensors, meters and data gateway set-up
   - Renewable energy sources plant data acquisition (PV, Cogeneration, etc...)

3. **Monitoring and Optimization**
   - Cloud-based solution for monitoring and optimization of Energy, gas, heat and water
   - Amazon AWS IoT for data ingestion, advanced analytics and real-time optimization

4. **Monitoring and Optimization**
   - Consumption curves analysis
   - Identification of lines to be optimized
   - Models fine-tuning and sensors integration
   - Renewable energy or cogeneration system design
Beneficios de colaborar con AWS
Solución IoT de Enel

- Time to Market
- Future Proof
- Strategic choice
- Scalability
Platforma IoT de Enel

Planificación

**Fase 1 - Finaliza en September 2017**

- **Análisis Funcional y Técnico**
  - Acabada (Mayo)

- **Sprint y Test de Integración**
  - Septiembre

- **Test de Aceptación de Usuarios**
  - Septiembre

**Fase 2**

- **Sistema de Gestión y Eficiencia Energética**: Soluciones para Monitorización & Optimización Energética
- **Distribución**
  - (p.e. Eficiencia Energética en edificios)
- **Generación**
  - (p.e. Recogida de información de sensores de plantas para monitorización y mantienimiento predictivo)
Visión: Integración en los sistemas de Endesa

Estado actual
Visión: Integración en los sistemas de Endesa

Objetivo: Medidas MT (y BT)
Visión: Integración en los sistemas de Endesa
Objetivo: Sensores de Seguridad CT
Visión: Integración en los sistemas de Endesa
Objetivo: Sensores de Seguridad Operario
AWS IoT en Enel

Evolución

Proyectos Iniciales de IoT

Arquitectura IoT de nueva generación

2ª oleada de soluciones IoT
Wrap-up
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Validate hypotheses through experimentation
Validate hypotheses through experimentation

Try AWS IoT!